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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/776,202

-02/12/2004

Hiroshi Toyoda

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22852

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11/03/2005

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EXAMINER

VU, HUNG K

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 11/03/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No. 10/776,202	Applicant(s) TOYODA ET AL.	
	Examiner Hung Vu	Art Unit 2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 17 August 2005.
- 2a) ☒ This action is FINAL.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 19-25 and 30-42 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 19-25 and 30-42 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 19-25 and 30-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Venkatraman et al. (PN 6,093,966) in view of Danek et al. (PN 5,942,799).

Venkatraman et al. discloses, as shown in Figures 3-10, a semiconductor device, comprising:

a wiring (170) disposed in a predetermined pattern above a substrate (100) and mainly comprising a first metal element (Al);

a protecting conductive layer (210) disposed on a pad section of the wiring and mainly comprising a second metal element (Cu) different from the first metal element;

a barrier film (200,201), disposed between the wiring and the protecting conductive layer.

Venkatraman et al. does not disclose the barrier film comprises two pairs or more of a layer made of a predetermined metal element and a layer made of a compound mainly comprising the predetermined metal element. However, Danek et al. discloses a semiconductor device comprising a barrier (12,20,40,60) comprises two pairs or more of a layer made of a predetermined metal element and a layer made of a compound mainly comprising the predetermined metal element. Note Figures 1-2 and 4-6 of Danek et al.. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the barrier film of Venkatraman et al. comprising two pairs or more of a layer made of a

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predetermined metal element and a layer made of a compound mainly comprising the predetermined metal element, such as taught by Danek et al. in order to provide high electrical conductivity to carry current efficiently with fast response time and additionally suppress diffusion between interconnect conductor and the semiconductor device.

Regarding claims 20, 31 and 38, Venkatraman et al. and Danek et al. disclose the layer made of the predetermined metal element has the thickness of 5 nm. Venkatraman et al. and Danek et al. do not disclose the thickness of the layer made of the compound mainly comprising the predetermined metal element. Although Venkatraman et al. and Danek et al. do not teach the thickness of the layer made of the compound, as that claimed by Applicants, however, it would have been obvious to one having ordinary skill in the art at the time the invention was made to form the layer made of the compound having a desired thickness, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claims 21, 32 and 39, Venkatraman et al. and Danek et al. disclose the barrier film is formed by stacking six pairs or less.

Regarding claims 22, 33 and 40, Venkatraman et al. and Danek et al. disclose the barrier film is formed of the same pairs only

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Regarding claims 23, 34 and 41, Venkatraman et al. and Danek et al. disclose the predetermined metal element is selected from Group IVa, Group Va or Group VIa.

Regarding claims 24, 35 and 42, Venkatraman et al. and Danek et al. disclose the compound is nitride.

Regarding claims 25 and 36, Venkatraman et al. and Danek et al. disclose all of the claimed limitations except material of wiring, the protecting conductive layer and the barrier film. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the device of Venkatraman et al. and Danek et al. having the materials as that claimed by Applicant, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Regarding claim 30, Venkatraman et al. discloses, as shown in Figures 3-10, a semiconductor device, comprising:

- a wiring (170) including a pad section, disposed in a predetermined pattern above a substrate (100);

- an insulating film (180,185,190) formed on the wiring and having an opening at a position corresponding to the pad section;

- a protecting (210) conductive layer disposed on the pad section of the wiring;

- a barrier film (200,201), disposed between the wiring and the protecting conductive layer and on a sidewall of the opening of the insulating film.

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Venkatraman et al. does not disclose the barrier film comprises two pairs or more of a layer made of a predetermined metal element and a layer made of a compound mainly comprising the predetermined metal element. However, Danek et al. discloses a semiconductor device comprising a barrier (12,20,40,60) comprises two pairs or more of a layer made of a predetermined metal element and a layer made of a compound mainly comprising the predetermined metal element. Note Figures 1-2 and 4-6 of Danek et al.. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the barrier film of Venkatraman et al. comprising two pairs or more of a layer made of a predetermined metal element and a layer made of a compound mainly comprising the predetermined metal element, such as taught by Danek et al. in order to provide high electrical conductivity to carry current efficiently with fast response time and additionally suppress diffusion between interconnect conductor and the semiconductor device.

Regarding claim 37, Venkatraman et al. and Danek et al. disclose the wiring mainly comprises a first metal element and the protecting conductive layer mainly comprises a second metal element different from the first metal element.

### ***Response to Arguments***

2. Applicant's arguments with respect to claim 19 have been considered but are moot in view of the new ground(s) of rejection.

*Conclusion*

3. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hung Vu whose telephone number is (571) 272-1666. The examiner can normally be reached on Tuesday to Friday 6:00-4:30.

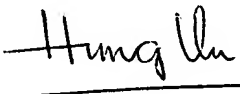
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on (571) 272 - 1732. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Vu

October 26, 2005

A handwritten signature in black ink, appearing to read "Hung Vu", is written over a horizontal line.

Hung Vu

Primary Examiner